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### (54) BACTERIA AS ODOR CONTROL AGENT FOR CARPETS

BAKTERIEN ALS MITTEL FÜR TEPPICHE ZUR UNTERDRÜCKUNG VON SCHLECHTEN  
GERÜCHEN

BACTERIES UTILES COMME AGENT DE NEUTRALISATION D'ODEURS POUR MOQUETTES

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(56) References cited:  
**WO-A-96/19611 US-A- 4 680 212  
US-A- 4 925 707**

- CHEMICAL ABSTRACTS, vol. 108, no. 20, May 1998 (1998-05) Columbus, Ohio, US; abstract no. 169120y, XP002122802 & CS 246 119 A (DOSTAL JAROSLAV; VIEST MIROSLAV) 16 October 1986 (1986-10-16)
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**Description****FIELD OF THE INVENTION**

5 [0001] The present invention is directed to a method of controlling odor associated with deposits, particularly spills of organic material on carpet or other fibrous material and to an odor control agent for use in the method. The odor control agent can be applied to the carpet or other fibrous material at various stages during manufacture or use and the effect of the odor control agent is long lasting.

**10 BACKGROUND OF THE INVENTION**

[0002] Carpet is used extensively in residential and commercial buildings as it is a relatively inexpensive and easy to install floor covering material. Carpet offers a number of desirable qualities including durability, aesthetics, comfort, safety, warmth and quietness. With modern manufacturing and dyeing techniques, carpeting may also be provided in almost any color, texture and pattern. Carpet may be manufactured from diverse types of materials including natural materials such as wool or cotton or synthetic materials from various polymers such as polypropylene, polyamide, etc. The majority of carpet, particularly for residential and commercial use, is manufactured from synthetic polymer material with polypropylene and polyamide, most commonly nylon 6 or nylon 66. Irrespective of the material used in the manufacture, the fibers are used in the form of continuous filament yarns, and in various forms as cut fiber or staple fiber.

20 One conventional manufacturing process involves inserting plied yarn into a primary backing of jute or polypropylene fibers, dyeing the fibers and then applying a carpet backing adhesive such as latex which is adhered to a secondary backing material.

[0003] Many carpet fibers, such as polypropylene and wool, and particularly nylon may be susceptible to staining especially from the many food dyes used in beverages and other foods as well as from other chemicals from many sources. Nylon carpet fibers are often treated with stain blockers such as sulfonated phenol formaldehyde condensate polymer, a sulfonated naphthol formaldehyde condensate polymer, a hydrolyzed vinyl aromatic maleic anhydride polymer or combinations thereof. The stain blockers act to prevent or reduce the ability of organic dyes, particularly acid dye colorants from chemically reacting with and bonding to the nylon. The carpets are also commonly coated with a fluorochemical anti-soiling agent to improve the anti-staining or anti-soiling characteristics of the carpet surface. The fluorochemicals reduce the tendency of soil to adhere to the fiber making the clean-up of any spills or soil on the carpet easier. The fluorochemicals also induce fiber wettability, making for easy clean up of liquid spills through a simple process of blotting the spill. Examples of such fluorochemicals and other stain resistant chemicals are given, for example, in US-A-4,680,212 and US-A-4,925,707. The use of the stain blockers and fluorochemicals may not provide complete stain resistance to the carpet, as some materials may still penetrate the nylon fibers or react with the fibers, especially if left in contact with the carpet for extended periods of time. This may be especially true where the carpet is exposed to conditions such as direct sunlight or other UV sources or high traffic areas, as these conditions may cause the effectiveness of the fluorochemical and stain blocker coatings to be diminished.

[0004] In addition, especially in residential locations, the possibility of deposits of organic matter such as feces or urine from babies and pets can result in not only soiling of the carpet but also a lingering odor and may, in extreme cases, require the replacement of the carpet. In the past, various chemical compounds have been proposed to aid in removing odor in a cleaning process. Such chemicals generally act as odor inhibiting agents although US-A-4,946,672 describes the use of biguanidine polymer compositions as odor inhibiting agents. However, even in those cases where the deposit is cleaned up and odor inhibiting agents utilized, the odor from such deposits may remain in the carpet and may become apparent as the effect of the odor masking agents wear off.

[0005] Deposits of various materials on carpet may also give rise to other concerns. Many of the deposit materials are capable of supporting bacterial growth, especially in the case of feces which contains many bacteria. Some of the bacteria that may grow, as a result of a deposit, may have the potential of causing disease in persons exposed to them, such as mold and mildew. Carpet and other fibrous material are also known to contain a number of naturally occurring bacteria and other organisms. Some of these bacteria may themselves give rise to odor due to incomplete digestion of organic material. There have been attempts to reduce the presence and number of bacteria present in carpet by utilizing various anti-microbial agents such as described in US-A-4,110,504 and US-A-5,024,840. These agents are applied to carpet in a manner similar to the way stain blockers are applied to carpet. The use of anti-microbials, while reducing the number of bacteria associated with carpet, may raise other concerns such as the potential that some of the bacteria may become resistant to effects of the anti-microbials.

[0006] Many bacterial and fungal genera are known for use in odor control due to their capability for producing enzymes which are capable of breaking down organic material. Such bacteria are particularly useful where the organic material, if allowed to remain, will give rise to malodors. Several such bacterial and fungal genera such as Bacillus, Lactobacillus, Enterobacter, Streptococcus, Rhizopus, Nitrosomonas, Nitrobacter, Pseudomonas, Alcaligenes and

Klebsiella, among others, are known for use in such applications with Bacillus sp. being the most prevalent in use in various applications.

5 [0007] For example, EP-A-732,396 describes the use of Bacillus sp. for odor control of feedstuffs used in farming and JP-A-7 031,668 describes their use for odor control of toilets, shoe boxes and pet litter. Other uses of the Bacillus for odor control for baby diapers and wall paper are described in JP-A-2 121,665 and JP-A-3 059,199 respectively. Preparations of active Bacillus in a vegetative form suitable for spraying or otherwise distributing on a deposit, especially of pet urine and feces, on a carpet for controlling odor are presently marketed by The Bramton Company of Dallas, Texas under the trademark OUTRIGHT. The bacterial preparations are used to deodorize a deposit by application directly on the deposit. Once the deposit is deodorized, the bacteria are depleted from the site or disposed of along with the deodorized material. In the event of a new deposit on the carpet, the treatment must be repeated. In all of these circumstances, the Bacillus or other strains of bacteria are used in an active or vegetative state as fully developed bacterial cells capable of immediate growth. It has been thought in the art that the bacteria must be in the active state to be effective, and that dormant or sporulated bacterial forms are ineffective.

10 15 [0008] There thus remains a need for a means for treating carpet and other fibrous material to counteract the effects of deposits and especially for controlling odor associated with the deposits, particularly deposited organic material, where the effects of the odor control are preventative and long lasting.

### SUMMARY OF THE INVENTION

20 [0009] The present invention provides in one aspect for a method for controlling odor associated with deposits of organic odor causing material on carpets and other fibrous materials. The method comprises applying to the carpet or other fibrous material, a preparation of dormant bacteria, which, when activated, is effective to control odors. The dormant bacterial preparation is allowed to become associated with the carpet or other fibrous material, such that when the carpet or other fibrous material is exposed to organic material which can cause odors, the bacteria are capable of 25 becoming active and digesting the organic material.

[0010] In another aspect of the invention there is provided an aqueous odor controlling bacterial composition for treating carpet or fabric to impart odor control. The composition comprises a stain blocker chemical and an effective amount of dormant odor controlling bacteria.

30 BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Preferred embodiments of the invention are shown in the drawings, wherein:

35 Figure 1 illustrates scanning electron microscope pictures of carpet fibers containing no inoculum (Fig. 1A) and carpet fibers inoculated with a preferred bacterial spore blend prepared according to Example 1 of the present invention (Fig 1B);  
 Figure 2 is a graph illustrating the germination and growth of the bacteria spore blend on various organic soils; Figure 3 is a graph illustrating the germination and growth of the bacterial spore blend in nylon carpet containing plate count broth; and  
 40 Figure 4 is a graph illustrating the germination and growth of the bacterial spore blend on carpet containing a combination of fox urine and dog feces.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

45 [0012] The present invention is directed in one aspect to a method of controlling odor associated with deposits, particularly spills, of organic material which can cause odors on carpet or other fibrous materials. The present invention is also directed to the compositions useful for preparing carpet or other fibrous material to make them capable of controlling odor as well as to the carpet so prepared. In addition to controlling odor, the compositions may also aid in reducing the staining effects of organic material.

50 [0013] Many bacterial genera are known to produce enzymes which are capable of breaking down organic material. Such bacteria are particularly useful where the organic material, if allowed to remain, will give rise to malodors. Several such bacterial genera such as Bacillus, Lactobacillus, Enterobacter, Streptococcus, Nitrosomonas, Nitrobacter, Pseudomonas, Alcaligenes and Klebsiella amongst others are known for use in such applications, with Bacillus and Lactobacillus sp. being the most prevalent in use in various applications. Strains of bacteria from any of the above noted 55 genera are useful in practicing the present invention. Preferably, the bacterial preparation for use in the present invention is one or more strains of Bacillus or Lactobacillus. More preferably, the strains of bacteria for use in the present invention are selected from Bacillus licheniformis, Bacillus pasteurii, Bacillus laevolacticus and Bacillus amyloliquefaciens. Each of these species have characteristics which make them most effective against particular types of organic

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fluorochemicals include products sold under the trademarks STAINMASTER, STAINMASTER with TEFLON, and ZONYL by DuPont and SCOTCHGARD by 3M.

[0018] The selection of the suitable fluorochemicals and stainblocker is well within the knowledge of those of skill in the art. Preferably, the fluorochemicals and stainblockers selected are soluble in water, particularly when the composition is to be used on installed carpet. When utilized during the manufacture of the carpet material, the fluorochemicals and stainblocker may be non-water soluble, provided as a dispersant preparation in which the elevated temperatures during the manufacturing process are used to bind the fluorochemicals and stainblocker to the carpet fiber and affix or attach the bacteria in the process. The use of the stain blocker and/or fluorochemical in the preparation improves the ability of the spores to become associated with the fibers. This provides increased protection of the bacteria from subsequent removal by vacuuming the possible adverse effects of environmental factors. The stain blocker and/or fluorochemical are thought to provide a protective encapsulation of the bacteria to aid in the protection of the bacteria from exposure to potentially harmful conditions such as traffic or the effects of cleaning.

[0019] The amount of the stain blocker and/or fluorochemical used in the preparations of the present invention are the amounts typically employed in the carpet and fabric industry and would be well known to those skilled in the art. Ordinarily, depending upon the nature of the stain blocker or fluorochemical and the material being treated and its location, the agents are applied to the material in an amount to result in a treatment rate of about 0.1 wt% to about 20 wt% based upon the weight of the nylon or other fibrous material being treated and the amount of stain blocker and/or fluorochemical. Commonly, the treatment rate will be from about 0.15 wt% to about 10 wt%, preferably from about 0.2 wt% to about 4 wt%, more preferably from about 0.25 wt% to about 2 wt%. Most preferably, the stain blocker or fluorochemical are applied to give a treat rate of about 0.25 wt% to 1.0 wt% based upon the weight of the nylon or other fibrous material being treated.

[0020] The term "dormant cells" is intended to encompass cells which are in a state which are required to be activated before they can undergo growth. One example of a dormant cell is a sporulated form of the bacteria where the spores must undergo activation and germination before growth of the bacteria can occur.

[0021] By providing the bacteria in a dormant or sporulated form, the bacteria are further protected from environmental factors which may prove detrimental to active bacterial cells. These environmental factors may include low moisture or humidity, as the carpet or other fibrous material would generally be kept in a dry state. Other factors may include exposure to heat, chemical agents, UV radiation from sunlight as well as the exposure to air for those strains which may be predominantly anaerobic.

[0022] The sporulated or dormant strains of bacteria become activated and undergo germination in response to being exposed to organic material including organic material which can cause odors. The factors which promote the activation of the dormant or sporulated bacteria include the moisture and various organic compounds present in the deposit of organic material. Once activated, the bacteria undergo growth and replication, consuming the organic material in the deposit until the material is consumed. After the material is consumed, the bacteria will then become dormant by undergoing sporulation to await exposure to another deposit of organic material. It is thought that the bacteria will also be somewhat cannibalistic, in that as the bacteria break down after the depletion of the organic material, the degradation products of the break down would be utilized as a food source by other of the bacteria. Once the potential energy source is reduced and the number of bacteria is also reduced, it is thought that the remaining bacteria undergo sporulation to return to a dormant state.

[0023] The bacterial preparation may be provided as a concentrate to be diluted with the stain blocker and/or fluorochemical formulation prior to application. If provided as a concentrate, the concentrate may include other agents for improving viability of the bacterial preparation. The concentrate preferably contains between 10 and 20 times the number of cells or spores per ml of the final preparation. To prepare the final preparation 5% to 10% by volume of the concentrate is mixed with 90% to 95% by volume of the stain blocker and/or fluorochemical formulation. Thus, each ml of the concentrate is mixed with 10 to 20 ml of the stain blocker and/or fluorochemical formulation to prepare the bacterial preparation for application to carpet and other fibrous material.

[0024] When treating carpet, the aqueous odor controlling bacterial composition may be applied to the carpet at any stage during its manufacture. For example, the composition may be utilized to treat the precursor filaments, yarns or fibers prior to their use in the conventional manufacturing process. The filament or yarn may be run through a bath containing the aqueous solution of the bacterial preparation or the bacterial preparation may be sprayed on the filament. After the treatment, the filaments or yarns are dried and then further processed into carpet in the normal manner. Alternatively, the carpet during the manufacturing process may be immersed, sprayed or otherwise treated with the aqueous composition. The carpet fibers may be sprayed or otherwise treated with the bacterial preparation prior to being inserted into the primary backing. Alternatively, the fibers may also be treated once they have been inserted into the primary backing, either before or after the backing adhesive and secondary backing material have been applied. The composition may also be applied to the finished carpet as a final step prior to drying and rolling. The carpet would be sprayed or otherwise treated with the aqueous bacterial preparation, after which time the carpet would be dried in the usual manner and rolled onto the roll.

[0025] Another option would be to apply the composition to an installed carpet. When applying the composition to an installed carpet, it is preferred that the composition be applied thoroughly and evenly throughout the length of the pile, especially reaching down to the base of the pile fiber. This is generally achieved by applying the aqueous bacterial preparation to the carpet and then working the fibers to improve the contact, distribution and penetration of the bacterial preparation. This is most commonly achieved by use of a pile brush operated either by hand or automatically for example, utilizing a cleaning device such as is commonly available commercially. To enhance the penetration of the bacterial preparation, the fibers of the carpet may initially be wetted through an application of a detergent solution. This is most commonly applied where the installed carpet is cleaned using a cleaning machine prior to the application of the bacterial preparation. While the carpet fibers are still moist, the bacterial preparation may be applied and worked into the carpet, utilizing the pile brush. Once the carpet has been so treated, it is dried, either by allowing it to dry in the air at ambient temperature or through the use of hot air blown through the pile of the carpet to increase the speed of drying of the carpet. Depending upon the state of the carpet or other fibrous material, the composition may be applied in many different ways. The composition may be applied by dipping the material in the composition or by spraying the composition onto the fibrous material. In any of these cases, once the fiber or carpet is treated with the composition, the treated carpet material is allowed to dry by way of applied heat or simply by ambient drying. Alternatively, or in addition to treating the carpet fiber with the aqueous composition, the carpet backing and/or carpet cushion underlayment may also be treated with the bacterial preparation. Once again, the carpet backing and/or carpet cushion underlayment may be treated during the manufacturing process, or prior to its installation. The carpet cushion underlayment may also be similarly treated during the installation of the carpet cushion underlayment.

[0026] The following examples illustrate the use of the present invention but are not to be construed as limiting the scope of the present invention.

#### Example 1

[0027] A known weight of carpet was conditioned at 50% humidity at 75°F. After conditioning, the carpet was sprayed with a suspension of a mixture of sporulated forms of Bacillus sp. having the following formulation:

Species	% of total bacteria
<u>Bacillus licheniformis</u>	40
<u>Bacillus pasteurii</u>	20
<u>Bacillus laevolacticus</u>	20
<u>Bacillus amyloliquefaciens</u>	20

The bacterial suspension was prepared in an aqueous solution of 5% ZONYL 7044 fluorochemical in distilled water at a concentration of  $10^8$  spores per ml. The bacterial suspension was applied to the carpet in an aerosol form to provide a treatment rate of  $10^7$  spores per gram of carpet. After the application of the bacterial suspension, the carpet was dried at 290°F in an oven in a humidity controlled chamber for 20 minutes. A sample of the carpet fiber treated with the bacterial suspension was compared with a sample of untreated carpet fiber by scanning electron microscopy. The results of this comparison are shown in Figure 1 where Figure 1a illustrates the carpet fiber containing naturally occurring bacteria and other microorganisms adhered to the carpet fiber which was not treated. Figure 1b illustrates a carpet fiber inoculated with the bacterial spore preparation. As can be seen in the micrographs, the treated carpet fiber has a large number of Bacillus spores adhered to the surface of the fiber with very little, if any naturally occurring bacteria or other microorganisms present in the sample.

#### Example 2

[0028] Samples of carpet fiber and plate count broth were examined for oxygen uptake using a standard respirometric study. Oxygen uptake is commonly utilized in those applications where it is not possible to easily measure bacterial growth by other methods. It is known that for aerobic bacteria, oxygen uptake is directly proportional to bacteria count, with the greater the uptake, the higher the corresponding bacteria count would be. The respirometric studies were conducted using a Challenge AER100 respirometer with all samples incubated under controlled temperature conditions. The treatment reactors were 500 ml bottles with CO<sub>2</sub> adsorption trap inserts containing 5 ml of 30% KOH (w/v) with alizarin yellow pH indicator. The sterilized traps were filled with the KOH caustic solution then inserted into the sterilized reactors using aseptic techniques. The CO<sub>2</sub> traps also contained sterilized medical cotton rolls used as wicks to increase the surface area of the caustic solution. Each reactor was provided with sufficient carpet material to yield 5 grams of carpet fiber. A plate count broth prepared by mixing 17g Difco Plate Count Broth, 0.073g KH<sub>2</sub>PO<sub>4</sub>, 0.114g

K<sub>2</sub>HPO<sub>4</sub> per liter of distilled water and the pH adjusted to 7 was added to the reactor and the reactors autoclaved to sterilize them. The reactors were allowed to cool and 0.5 ml of the bacterial suspension utilized in Example 1 containing 10<sup>8</sup> spores per ml were added to the test reactors. The same volume of distilled water was added to the control reactors. The reactors were capped without the caustic traps and rolled and swirled to ensure that the water and bacterial preparations were mixed well with the organic materials and to permit the carpet to absorb the liquid. The caustic traps were then inserted into the reactors and the reactors hooked up to the respirometer systems. The reactors were incubated in a water temperature bath maintained at 23 °C using an automatic temperature controller. The oxygen uptake by any bacteria growing in the reactors was monitored continuously and reported at 2 hour intervals.

[0029] As illustrated in Figure 2, carpet fiber which had not been inoculated with the bacterial spore blend demonstrated only a very slight increase in oxygen uptake after about 24 hours of incubation. The oxygen uptake did not increase above this level up to 60 hours post-inoculation. These results indicate minimal bacterial growth in the control carpet sample. In contrast, the carpet fiber inoculated with the bacterial spore blend showed an increase in oxygen uptake starting 22 to 24 hours after inoculation. This increase in oxygen uptake continued up to the end of the test at 60 hours post-incubation with the oxygen intake increasing in a steady linear fashion with no leveling off of the uptake seen during the 60 hours of the test. These results indicate that the dormant bacteria are capable of germinating to become active and undergo growth in response to exposure to a suitable food source.

#### Example 3

[0030] To confirm that the bacterial spore blend utilized in the present invention could grow on various organic soils, plates containing materials representative of common household or soil causing organic based materials were inoculated with the bacterial spore blend. The organic based materials utilized were chocolate syrup, tomato sauce, milk, dog feces and fox urine. The growth on these soils was compared to a standard plate count broth utilized for counting colony forming units. The plates were inoculated with dilutions of the bacterial spore blend to give between about 300 and 400 spores per plate and incubated at 37°C and 50% humidity. At two days and four days post inoculation, the colony forming units (CFU) were counted and the CFU's per ml of the inoculum were calculated. As shown in Figure 2, after two days, the bacterial preparations were growing well on the tomato sauce, chocolate syrup and dog feces, with growth almost at the level of the standard plate count broth. A minimal increase in growth on the autoclaved milk or fox urine was observed after two days, although there was some growth. After four days, the growth on all five materials was comparable, being only slightly less than the growth on the plate count broth. These results indicate that the bacterial spore blend can grow well on common organic soil, such as chocolate syrup, tomato sauce, dog faces and fox urine.

#### Example 4

[0031] The bacterial spore blend was tested using respirometric studies as set out in Example 2 above to confirm that it could utilize pet waste for growth in carpets. Samples of the carpet fiber were examined for oxygen uptake using a standard respirometric study conducted using a Challenge AER100 respirometer with all samples incubated under controlled temperature conditions. The treatment reactors were 500 ml bottles. The CO<sub>2</sub> adsorption trap inserts contained 5 ml of 30% KOH (w/v) with alizarin yellow pH indicator. The sterilized traps were filled with the KOH caustic solution then inserted into the sterilized reactors using aseptic techniques. The CO<sub>2</sub> traps also contained sterilized medical cotton rolls used as wicks to increase the surface area of the caustic solution. Each reactor was provided with sufficient carpet material to yield 5 grams of carpet fiber. The organic material (i.e. dog feces, fox urine, plate count broth, etc.) was added to the reactor and the reactors autoclaved to sterilize them. The reactors were allowed to cool and 0.5 ml of the bacterial suspension containing 10<sup>8</sup> spores per ml were added to the test reactors. The same volume of distilled water was added to the control reactors. The reactors were capped without the caustic traps and rolled and swirled to ensure that the water and bacterial preparations were mixed well with the organic materials and to permit the carpet to absorb the liquid. The caustic traps were then inserted into the reactors and the reactors hooked up to the respirometer systems. The reactors were incubated in a water temperature bath maintained at 23 °C using an automatic temperature controller. The oxygen uptake in the reactors was monitored continuously and reported at 2 hour intervals.

[0032] As shown in Figure 4, the carpet sample in the control reactor with no inoculum did not have any significant increase in oxygen uptake over the 96 hours of the test. The carpet samples which had been inoculated with the bacterial spore blend started showing an increase in oxygen uptake after 32 hours post-inoculation. This increase in oxygen uptake continued to the end of the test in a linear fashion with no plateauing of the oxygen uptake observed up to 96 hours post-inoculation. This clearly shows that the bacterial spore blend associated with the carpet can become activated and undergo growth when exposed to a common organic spill material.

[0033] The compositions and method of the present invention provide for effective odor control for carpet. The use

of the bacterial preparations, particularly the sporulated forms of Bacillus, provide for control of odor caused by deposits of organic odor causing material on carpets and other fibrous material. Once the deposit comes into contact with the bacteria, the bacteria germinate if in the dormant form, and commence growing by feeding on the organic material as a food source. As can be observed from the above experiments with the sporulated Bacillus, this bacterial growth commences within about 24 and 48 hours after the bacteria encounter the deposit. In some circumstances, it may be desirable to mask the odor using odor masking agents until the sporulated bacteria can germinate, grow and effectively decompose the odor causing agents. Alternatively, the bacterial preparations may include suitable protease and lipase enzymes to commence the digestion of the odor causing material until the bacteria commence their growth stage and can take over the digestion of the odor causing material. As a further alternative, introducing suitable molecular sieves that can quickly bind the offensive odor within its' poors, allowing time for the sporulated bacteria to decompose the odor causing material.

[0034] It has surprisingly been found that the odor control agent applied to the carpet as described above remains effective for extended periods of time even with carpet exposed to high traffic and repeated vacuuming. The exact mechanism for this is not completely understood, but it is suspected that the dormant bacteria become so tightly associated with the carpet fibers that they are not easily removed when exposed to traffic or vacuuming. The use of the stain blocker and/or fluorochemical in the aqueous solution used in the application of the agent to the carpet is suspected to increase the association of the dormant bacteria with the carpet fibers, and hence increase the effective life of the treatment. It is suspected that the treatment may also remain after wet cleaning of the carpet. However, it is suggested that the carpet be treated with the odor controlling bacterial preparation on a routine basis such as after each wet cleaning. This can be easily accomplished after cleaning with the preparation applied to the carpet either when still wet from the cleaning or after the carpet has dried. Preferably, the preparation is applied to the carpet while still wet, worked into the carpet with a pile brush and the carpet is allowed to dry naturally.

[0035] In addition to providing for removal of potentially odor causing organic material associated with deposits on carpet and other fibrous material, the use of the bacterial preparations of the present invention provides other benefits. Based upon the observations from the electron micrographs, it is expected that the presence of the bacterial preparation in association with the carpet fiber and other fibrous material may result in a reduction in the presence of other bacteria and organisms which are naturally found on installed carpet and other fibrous material, both in number and population. It has also been found that the bacterial preparation associated with the carpet fiber or other fibrous material enhances the antistain characteristics of the carpet. Many of the stain causing materials are organic in nature and it has been found that the bacteria can utilize such organic materials as a food source. As the stain causing material is consumed by the bacteria, the staining properties of the compounds are reduced.

[0036] The method and compositions of the present invention are especially suitable for use with carpet as described in the specific examples set out above. These methods and compositions are also suitable for use with other fibrous material which may be susceptible to the effects of deposits of organic material. Examples of such other fibrous materials include rugs, upholstery fabrics, automotive fabrics, bedding, clothing, etc. Suitable binders may be determined to improve the longevity and efficacy to address wash and wearing performance. Other applications may include hard surfaces, such as ceramics, tile, walls, wood, etc.

[0037] Although various preferred embodiments of the present invention have been described herein in detail, it will be appreciated by those skilled in the art, that variations may be made thereto without departing from the scope of the appended claims.

## Claims

- 45 1. A method for controlling odor associated with deposits of organic material which can cause odors on carpets or other fibrous material, the method comprising applying to the carpet or other fibrous material or to the fibers used in the manufacture of the carpet or other fibrous material, a preparation of dormant bacteria, which when activated are effective to control odors, the dormant bacterial preparation being allowed to become associated with the carpet or other fibrous material such that when the carpet or other fibrous material is exposed to organic material which can cause odors, the bacteria are capable of becoming active and digesting the organic material.
- 50 2. A method as claimed in claim 1 wherein the dormant bacteria are sporulated forms of one or more strains selected from the bacterial genera Bacillus.
- 55 3. A method as claimed in claim 1 wherein the dormant bacteria are sporulated forms of one or more strains selected from the group of bacterial species consisting essentially of Bacillus licheniformis, Bacillus pasteurii, Bacillus laevolacticus and Bacillus amyloliquefaciens.

4. A method as claimed in claim 3 wherein the dormant bacteria are applied to the carpet at a concentration of between about  $10^6$  and about  $10^8$  cells per gram of carpet fiber.
5. A method as claimed in claim 4 wherein the dormant bacteria are applied to the carpet at a concentration of about  $10^7$  cells per gram of carpet fiber.
6. A method as claimed in claim 3 wherein the dormant bacterial preparation comprises:

	% of total bacteria
Species	Range
<u>Bacillus licheniformis</u>	20-60
<u>Bacillus pasteurii</u>	10-30
<u>Bacillus laevolacticus</u>	10-30
<u>Bacillus amyloliquefaciens</u>	10-30

7. A method as claimed in claim 3 wherein the dormant bacterial preparation comprises:
- 20
- |                                   | % of total bacteria |
|-----------------------------------|---------------------|
| Species                           |                     |
| <u>Bacillus licheniformis</u>     | 40                  |
| <u>Bacillus pasteurii</u>         | 20                  |
| <u>Bacillus laevolacticus</u>     | 20                  |
| <u>Bacillus amyloliquefaciens</u> | 20                  |
- 25
8. A method as claimed in claim 3 wherein the bacterial preparation includes one or more stain-blocking chemicals.
- 30
9. A method as claimed in claim 8 wherein the one or more stain-blocking chemicals are selected from the group consisting of sulfonated phenol formaldehyde condensate polymer, sulfonated naphthal formaldehyde condensate polymer, and hydrolyzed vinyl aromatic maleic anhydride polymer.
- 35
10. A method as claimed in claim 9, wherein the preparation containing an amount of stain-blocking chemical is applied in an amount so as to result in treatment rate of between 0.1 wt % and about 20 wt % based on the weight of carpet fibre being treated and the amount of stain-blocking chemical.
- 40
11. A method as claimed in claim 10, wherein the treatment rate is between 0.25 wt % and about 20 wt %.
12. A method as claimed in claim 9 wherein the bacterial preparation further includes one or more anti-soil fluorochlorides.
- 45
13. An aqueous odor controlling bacterial composition for treating carpet or other fibrous material to impart odor control to the carpet or other fibrous material, the composition comprising one or more stain-blocker chemicals and an effective amount of dormant odor controlling bacteria.
- 50
14. An aqueous odor controlling bacterial composition as claimed in claim 13 wherein the dormant bacteria are one or more strains selected from the group of bacterial genera consisting of Bacillus, Enterobacter, Streptococcus, Nitrosomonas, Nitrobacter, Pseudomonas, Alcaligenes and Klebsiella.
15. An aqueous odor controlling bacterial composition as claimed in claim 14 wherein the dormant bacteria are one or more strains selected from the group of bacterial species consisting essentially of Bacillus licheniformis, Bacillus pasteurii, Bacillus laevolacticus and Bacillus amyloliquefaciens.
- 55
16. An aqueous odor controlling bacterial composition as claimed in claim 15 wherein the dormant bacteria are for application to a carpet or other fibrous material at a concentration of between about  $10^6$  and about  $10^8$  cells per gram of carpet fiber.

17. An aqueous odor controlling bacterial composition as claimed in claim 16 wherein the dormant bacteria are for application to a carpet or other fibrous material at a concentration of about  $10^7$  cells per gram of carpet fiber.
- 5      18. An aqueous odor controlling bacterial composition as claimed in claim 15 wherein the dormant bacterial preparation comprises:

% of total bacteria		
	Species	Range
10	<u>Bacillus licheniformis</u>	20-60
	<u>Bacillus pasteurii</u>	10-30
	<u>Bacillus laevolacticus</u>	10-30
	<u>Bacillus amyloliquefaciens</u>	10-30

- 15      19. An aqueous odor controlling bacterial composition as claimed in claim 15 wherein the dormant bacterial preparation comprises:

	% of total bacteria	
	Species	
20	<u>Bacillus licheniformis</u>	40
	<u>Bacillus pasteurii</u>	20
	<u>Bacillus laevolacticus</u>	20
25	<u>Bacillus amyloliquefaciens</u>	20

20. An aqueous odor controlling bacterial composition as claimed in claim 15 wherein the one or more stain-blocking chemicals are selected from the group consisting of sulfonated phenol formaldehyde condensate polymer, sulfonated naphthol formaldehyde condensate polymer, and hydrolyzed vinyl aromatic maleic anhydride polymer.
- 30      21. An aqueous odor controlling bacterial composition as claimed in claim 20 wherein the bacterial composition further includes one or more anti-soil fluorochemicals.
- 35      22. A carpet capable of controlling odor associated with deposits of organic material which can cause odors on the carpet, the carpet comprising fibers tufted through a primary backing, the fibers having associated therewith a preparation of dormant bacteria, which when activated are effective to control odors, such that when the carpet is exposed to organic material which can cause odors, the bacteria are capable of becoming active and digesting the organic material.
- 40      23. A carpet as claimed in claim 22 wherein the bacteria are one or more strains selected from the group of bacterial genera Bacillus.
- 45      24. A carpet as claimed in claim 22 wherein the bacteria are one or more strains selected from the group of bacterial species consisting essentially of Bacillus licheniformis, Bacillus pasteurii, Bacillus laevolacticus and Bacillus amyloliquefaciens.
- 50      25. A carpet as claimed in claim 24 wherein the dormant bacteria are applied to the carpet at a concentration of between about  $10^6$  and about  $10^8$  cells per gram of carpet fiber.
- 55      26. A carpet as claimed in claim 25 wherein the dormant bacteria are applied to the carpet at a concentration of about  $10^7$  cells per gram of carpet fiber.
27. A carpet as claimed in claim 24 wherein the dormant bacterial preparation comprises:

	% of total bacteria
Species	Range
<u>Bacillus licheniformis</u>	20-60
<u>Bacillus pasteurii</u>	10-30
<u>Bacillus laevolacticus</u>	10-30
<u>Bacillus amyloliquefaciens</u>	10-30

10 28. A carpet as claimed in claim 24 wherein the dormant bacterial preparation comprises:

	% of total bacteria
Species	
<u>Bacillus licheniformis</u>	40
<u>Bacillus pasteurii</u>	20
<u>Bacillus laevolacticus</u>	20
<u>Bacillus amyloliquefaciens</u>	20

20 29. A carpet as claimed in claim 24 wherein the carpet has also been treated with one or more stain-blocking chemicals.

30 30. A carpet as claimed in claim 29 wherein the one or more stain-blocking chemicals are selected from the group consisting of sulfonated phenol formaldehyde condensate polymer, sulfonated naphthol formaldehyde condensate polymer, and hydrolyzed vinyl aromatic maleic anhydride polymer.

35 31. A carpet as claimed in claim 30, wherein the preparation containing an amount of stain-blocking chemical has been applied in an amount so as to result in a treatment rate of between 0.1 wt % and about 20 wt % based on the weight of carpet fibre being treated and the amount of stain-blocking chemical.

32. A carpet as claimed in claim 31 wherein the treatment rate is from about 0.25 wt% to about 20 wt%.

33. A carpet as claimed in claim 30 wherein the carpet has also been treated with one or more anti-soil fluorochemicals.

### 35 Revendications

1. Procédé de commande d'odeur associée à des dépôts d'une matière organique qui peuvent provoquer des odeurs sur des tapis et autre matériel fibreux, le procédé comportant l'application au tapis ou autre matériel fibreux ou aux fibres utilisées lors de la fabrication du tapis ou autre matériel fibreux, d'une préparation de bactéries dormantes, qui lorsqu'activées, sont efficaces pour commander des odeurs, la préparation de bactéries dormantes étant autorisée à s'associer au tapis ou autre matériel fibreux de sorte que, lorsque le tapis ou autre matériel fibreux est exposé à une matière organique qui peut provoquer des odeurs, les bactéries sont capables de devenir actives et de digérer la matière organique.

45 2. Procédé selon la revendication 1, dans lequel les bactéries dormantes sont des formes sporulées d'une ou plusieurs souches sélectionnées parmi le genre bactérien Bacillus.

50 3. Procédé selon la revendication 1, dans lequel les bactéries dormantes sont des formes sporulées d'une ou plusieurs souches sélectionnées parmi le groupe d'espèces bactériennes constituées essentiellement de Bacillus licheniformis, Bacillus pasteurii, Bacillus laevolacticus et Bacillus amyloliquefaciens.

4. Procédé selon la revendication 3, dans lequel les bactéries dormantes sont appliquées au tapis à une concentration comprise entre environ  $10^6$  et environ  $10^8$  cellules par gramme de fibre de tapis.

55 5. Procédé selon la revendication 4, dans lequel les bactéries dormantes sont appliquées au tapis à une concentration d'environ  $10^7$  cellules par gramme de fibre de tapis.

6. Procédé selon la revendication 3, dans lequel la préparation de bactéries dormantes comporte :

Espèces	% de bactéries totales
	Plage
<u>Bacillus licheniformis</u>	20-60
<u>Bacillus pasteurii</u>	10-30
<u>Bacillus laevolacticus</u>	10-30
<u>Bacillus amyloliquefaciens</u>	10-30

10

7. Procédé selon la revendication 3, dans lequel la préparation de bactéries dormantes comporte :

Espèces	% de bactéries totales
<u>Bacillus licheniformis</u>	40
<u>Bacillus pasteurii</u>	20
<u>Bacillus laevolacticus</u>	20
<u>Bacillus amyloliquefaciens</u>	20

20

8. Procédé selon la revendication 3, dans lequel la préparation de bactéries comporte un ou plusieurs composés chimiques de blocage de tache.

25 9. Procédé selon la revendication 8, dans lequel les un ou plusieurs composés chimiques de blocage de tache sont sélectionnés parmi le groupe constitué d'un polymère de condensat de phénol formaldéhyde sulfoné, d'un polymère de condensat de naphtol formaldéhyde sulfoné, et d'un polymère d'anhydride maléique aromatique vinylique hydrolysé.

30 10. Procédé selon la revendication 9, dans lequel la préparation contenant une quantité de composé chimique de blocage de tache est appliquée selon une quantité telle qu'il en résulte un taux de traitement compris entre 0,1 % en poids et environ 20 % en poids sur la base du poids de fibre de tapis qui est traitée et de la quantité de composé chimique de blocage de tache.

35 11. Procédé selon la revendication 10, dans lequel le taux de traitement est compris entre 0,25 % en poids et environ 20 % en poids.

12. Procédé selon la revendication 9, dans lequel la préparation bactérienne comporte de plus un ou plusieurs composés fluorochimiques anti-saleté.

40 13. Composition bactérienne aqueuse de commande d'odeur pour traiter un tapis ou autre matériel fibreux afin d'affecter une commande d'odeur au tapis ou autre matériel fibreux, la composition comportant un ou plusieurs composés chimiques de blocage de tache et une quantité efficace de bactéries dormantes de commande d'odeur.

45 14. Composition bactérienne aqueuse de commande d'odeur selon la revendication 13, dans laquelle les bactéries dormantes sont une ou plusieurs souches sélectionnées parmi le groupe des genres bactériens constitués de Bacillus, Enterobacter, Streptococcus, Nitrosomonas, Nitrobacter, Pseudomonas, Alcaligenes et Klebsiella.

50 15. Composition bactérienne aqueuse de commande d'odeur selon la revendication 14, dans laquelle les bactéries dormantes sont une ou plusieurs souches sélectionnées parmi le groupe d'espèces bactériennes constituées essentiellement de Bacillus licheniformis, Bacillus pasteurii, Bacillus laevolacticus et Bacillus amyloliquefaciens.

55 16. Composition bactérienne aqueuse de commande d'odeur selon la revendication 15, dans laquelle les bactéries dormantes sont destinées à une application à un tapis ou autre matériel fibreux à une concentration comprise entre environ  $10^6$  et environ  $10^8$  cellules par gramme de fibre de tapis.

17. Composition bactérienne aqueuse de commande d'odeur selon la revendication 16, dans laquelle les bactéries dormantes sont destinées à une application à un tapis ou autre matériel fibreux à une concentration d'environ  $10^7$

cellules par gramme de fibre de tapis.

18. Composition bactérienne aqueuse de commande d'odeur selon la revendication 15, dans laquelle la préparation de bactéries dormantes comporte :

Espèces	% de bactéries totales
	Plage
<u>Bacillus licheniformis</u>	20-60
<u>Bacillus pasteurii</u>	10-30
<u>Bacillus laevolacticus</u>	10-30
<u>Bacillus amyloliquefaciens</u>	10-30

19. Composition bactérienne aqueuse de commande d'odeur selon la revendication 15, dans laquelle la préparation de bactéries dormantes comporte :

Espèces	% de bactéries totales
<u>Bacillus licheniformis</u>	40
<u>Bacillus pasteurii</u>	20
<u>Bacillus laevolacticus</u>	20
<u>Bacillus amyloliquefaciens</u>	20

20. Composition bactérienne aqueuse de commande d'odeur selon la revendication 15, dans laquelle les un ou plusieurs composés chimiques de blocage de tache sont sélectionnés parmi le groupe constitué d'un polymère de condensat de phénol formaldéhyde sulfoné, d'un polymère de condensat de naphtol formaldéhyde sulfoné, et d'un polymère d'anhydride maléique aromatique vinylique hydrolysé.
21. Composition bactérienne aqueuse de commande d'odeur selon la revendication 20, dans laquelle la composition bactérienne comporte de plus un ou plusieurs composés fluorochimiques anti-saleté.
22. Tapis capable de commander une odeur associée à des dépôts de matière organique qui peuvent provoquer des odeurs sur le tapis, le tapis comportant des fibres touffetées par l'intermédiaire d'un support primaire, les fibres ayant une préparation de bactéries dormantes associée à celles-ci, qui lorsqu'activées, sont efficaces pour commander des odeurs, de sorte que lorsque le tapis est exposé à une matière organique qui peut provoquer des odeurs, les bactéries sont capables de devenir actives et de digérer la matière organique.
23. Tapis selon la revendication 22, dans lequel les bactéries sont une ou plusieurs souches sélectionnées parmi le groupe de genre bactérien Bacillus.
24. Tapis selon la revendication 22, dans lequel les bactéries sont une ou plusieurs souches sélectionnées parmi le groupe d'espèces bactériennes constituées essentiellement de Bacillus licheniformis, Bacillus pasteurii, Bacillus laevolacticus et Bacillus amyloliquefaciens.
25. Tapis selon la revendication 24, dans lequel les bactéries dormantes sont appliquées au tapis à une concentration comprise entre environ  $10^6$  et environ  $10^8$  cellules par gramme de fibre de tapis.
26. Tapis selon la revendication 25, dans lequel les bactéries dormantes sont appliquées au tapis à une concentration d'environ  $10^7$  cellules par gramme de fibre de tapis.
27. Tapis selon la revendication 24, dans lequel la préparation de bactéries dormantes comporte :

	% de bactéries totales
Espèces	Plage
<u>Bacillus licheniformis</u>	20-60
<u>Bacillus pasteurii</u>	10-30
<u>Bacillus laevolacticus</u>	10-30
<u>Bacillus amyloliquefaciens</u>	10-30

10 28. Tapis selon la revendication 24, dans lequel la préparation de bactéries dormantes comporte :

	% de bactéries totales
Espèces	
<u>Bacillus licheniformis</u>	40
<u>Bacillus pasteurii</u>	20
<u>Bacillus laevolacticus</u>	20
<u>Bacillus amyloliquefaciens</u>	20

20 29. Tapis selon la revendication 24, dans lequel le tapis a également été traité à l'aide d'un ou plusieurs composés chimiques de blocage de tache.

25 30. Tapis selon la revendication 29, dans lequel le ou les plusieurs composés chimiques de blocage de tache sont sélectionnés parmi le groupe constitué d'un polymère de condensat de phénol formaldéhyde sulfoné, d'un polymère de condensat de naphtol formaldéhyde sulfoné, et d'un polymère d'anhydride maléique aromatique vinylique hydrolysé.

30 31. Tapis selon la revendication 30, dans lequel la préparation contenant une quantité de composés chimique de blocage de tache a été appliquée selon une quantité telle qu'il en résulte un taux de traitement compris entre 0,1 % en poids et environ 20 % en poids sur la base du poids de la fibre de tapis qui est traitée et de la quantité de composé chimique de blocage de tache.

35 32. Tapis selon la revendication 31, dans lequel le taux de traitement est compris entre environ 0,25 % en poids et environ 20 % en poids.

33. Tapis selon la revendication 30, dans lequel le tapis a également été traité à l'aide d'un ou plusieurs composés fluorochimiques anti-saleté.

40 **Patentansprüche**

1. Verfahren zur Kontrolle von Geruch, der mit Ablagerungen von organischem Material, welches Gerüche auf Teppichen oder anderem Fasermaterial verursachen kann, einhergeht, bestehend aus der Aufbringung auf den Teppich oder auf anderes Fasermaterial oder auf die Fasern, die zur Herstellung des Teppichs oder anderen Fasermaterials verwendet werden, von einer Zubereitung aus Bakterien im Ruhezustand, welche, wenn aktiviert, erfolgreich in der Geruchskontrolle sind, wobei die bakterielle, im Ruhezustand befindliche Zubereitung mit dem Teppich oder anderem Fasermaterial in dauerhaften Kontakt gebracht wird, so dass im Falle, dass der Teppich oder anderes Fasermaterial geruchsverursachendem organischen Material ausgesetzt wird, die Bakterien aktiv werden können und das organische Material verdauen.
2. Verfahren gemäß Anspruch 1, wobei die Bakterien im Ruhezustand sporulierte Formen eines oder mehrerer Stämme des bakteriellen Genus *Bacillus* sind.
- 55 3. Verfahren gemäß Anspruch 1, wobei die Bakterien im Ruhezustand sporulierte Formen eines oder mehrerer Stämme aus der Gruppe der bakteriellen Spezies im wesentlichen bestehend aus *Bacillus licheniformis*, *Bacillus pasteurii*, *Bacillus laevolacticus* und *Bacillus amyloliquefaciens* sind.

4. Verfahren gemäß Anspruch 3, wobei die Bakterien im Ruhezustand dem Teppich oder anderem Fasermaterial in einer Konzentration von zwischen ungefähr  $10^8$  und ungefähr  $10^8$  Zellen pro Gramm Teppichfaser beigebracht werden.
5. Verfahren gemäß Anspruch 4, wobei die Bakterien im Ruhezustand dem Teppich oder anderem Fasermaterial in einer Konzentration von ungefähr  $10^7$  pro Gramm Teppichfaser beigebracht werden.
6. Verfahren gemäß Anspruch 3, wobei die Zubereitung der Bakterien im Ruhezustand

		% an Gesamt-Bakterien
	Spezies	Bereich
10	<u>Bacillus licheniformis</u>	20-60
15	<u>Bacillus pasteurii</u>	10-30
	<u>Bacillus laevolacticus</u>	10-30
	<u>Bacillus amyloliquefaciens</u>	10-30

enthält.

- 20 7. Verfahren gemäß Anspruch 3, wobei die Zubereitung der Bakterien im Ruhezustand

		% an Gesamt-Bakterien
	Spezies	
25	<u>Bacillus licheniformis</u>	40
	<u>Bacillus pasteurii</u>	20
	<u>Bacillus laevolacticus</u>	20
	<u>Bacillus amyloliquefaciens</u>	20

30 enthält.

- 35 8. Verfahren gemäß Anspruch 3, wobei die bakterielle Zubereitung ein oder mehrere fleckenhemmende Chemikalien enthält.

9. Verfahren gemäß Anspruch 8, wobei die eine oder mehreren fleckenhemmende(n) Chemikalie(n) aus der Gruppe bestehend aus sulfoniertem Phenolformaldehydkondensat-Polymer, sulfoniertem Naphtolformaldehydkondensat-Polymer und hydrolysiertem Vinylaromatischem-Maleinsäureanhydrid-Polymer ausgewählt wird/werden.

- 40 10. Verfahren gemäß Anspruch 9, wobei die Zubereitung, die eine Menge fleckenhemmende Chemikalie enthält, in einer solchen Menge zugefügt wird, dass ein Behandlungsverhältnis von zwischen 0,1 Gew.% und 20 Gew.%, gemessen am behandelten Teppichfasergewicht und der Menge an fleckenhemmender Chemikalie, erreicht wird.

11. Verfahren gemäß Anspruch 10, wobei das Behandlungsverhältnis zwischen 0,25 Gew.% und 20 Gew.% liegt.

- 45 12. Verfahren gemäß Anspruch 9, wobei die bakterielle Zubereitung weiterhin eine oder mehrere schmutzabweisende Fluorverbindungen aufweist.

13. Wässrige Zubereitung aus geruchskontrollierenden Bakterien für die Behandlung von Teppichen oder anderen 50 Fasermaterials, zur Ausstattung des Teppichs oder anderen Fasermaterials mit Geruchskontrolle, wobei die Mischung ein oder mehrere fleckenhemmende Chemikalien sowie eine wirkungsvolle Menge an geruchskontrollierenden Bakterien im Ruhezustand enthält.

14. Wässrige Zubereitung aus geruchskontrollierenden Bakterien gemäß Anspruch 13, wobei die Bakterien im Ruhezustand aus einem oder mehreren Stämmen der Gruppe der bakteriellen Genu Bacillus, Enterobacter, Streptococcus, Nitrosomonas, Nitrobacter, Pseudomonas, Alcaligenes und Klebsiella bestehen.

- 55 15. Wässrige Zubereitung aus geruchskontrollierenden Bakterien gemäß Anspruch 14, wobei die Bakterien im Ruhe-

zustand aus einem oder mehreren Stämmen der Gruppe der bakteriellen Spezies Bacillus licheniformis, Bacillus pasteurii, Bacillus laevolacticus und Bacillus amyloliquefaciens bestehen,

16. Wässrige Zubereitung aus geruchskontrollierenden Bakterien gemäß Anspruch 15, wobei die Bakterien im Ruhezustand dem Teppich oder anderem Fasermaterial in einer Konzentration von zwischen ungefähr  $10^6$  und ungefähr  $10^8$  Zellen pro Gramm Teppichfaser beigebracht werden.

5 17. Wässrige Zubereitung aus geruchskontrollierenden Bakterien gemäß Anspruch 16, wobei die Bakterien im Ruhezustand dem Teppich oder anderem Fasermaterial in einer Konzentration von ungefähr  $10^7$  pro Gramm Teppichfaser beigebracht werden.

10 18. Wässrige Zubereitung aus geruchskontrollierenden Bakterien gemäß Anspruch 15, wobei die Zubereitung aus Bakterien im Ruhezustand

15		% an Gesamt-Bakterien
	Spezies	Bereich
20	<u>Bacillus licheniformis</u>	20-60
	<u>Bacillus pasteurii</u>	10-30
	<u>Bacillus laevolacticus</u>	10-30
	<u>Bacillus amyloliquefaciens</u>	10-30

enthält.

25 19. Wässrige Zubereitung aus geruchskontrollierenden Bakterien gemäß Anspruch 15, wobei die Zubereitung aus Bakterien im Ruhezustand

30		% an Gesamt-Bakterien
	Spezies	
35	<u>Bacillus licheniformis</u>	40
	<u>Bacillus pasteurii</u>	20
	<u>Bacillus laevolacticus</u>	20
	<u>Bacillus amyloliquefaciens</u>	20

enthält.

40 20. Wässrige Zubereitung aus geruchskontrollierenden Bakterien gemäß Anspruch 15, wobei ein oder mehrere flekkenhemmende Chemikalien aus der Gruppe bestehend aus sulfoniertem Phenolformaldehydkondensat-Polymer, sulfoniertem Naphtolformaldehydkondensat-Polymer und hydrolysiertem Vinyl-aromatischem-Maleinsäureanhydrid-Polymer ausgewählt werden.

45 21. Wässrige Zubereitung aus geruchskontrollierenden Bakterien gemäß Anspruch 20, wobei die bakterielle Zubereitung weiterhin eine oder mehrere schmutzabweisende Fluorverbindungen aufweist.

50 22. Teppich mit der Fähigkeit der Kontrolle von Gerüchen, die mit der Ablagerung von organischem Material, welches Gerüche auf dem Teppich verursachen kann, einhergehen, wobei der Teppich aus Fasern besteht, die durch ein primäres Untergewebe gewebt sind, und die Fasern mit einer Zubereitung aus im Ruhezustand befindlichen Bakterien dauerhaft verbunden sind, welche bei Aktivierung erfolgreich in der Geruchskontrolle sind, so dass im Falle, dass der Teppich oder anderes Fasermaterial geruchsverursachendem organischen Material ausgesetzt wird, die Bakterien aktiv werden können und das organische Material verdauen.

55 23. Teppich gemäß Anspruch 22, wobei die Bakterien einem oder mehreren Stämmen des bakteriellen Genus Bacillus angehören.

24. Teppich gemäß Anspruch 22, wobei die Bakterien aus einem oder mehreren Stämmen der Gruppe der bakteriellen Spezies, im wesentlichen bestehend aus Bacillus licheniformis, Bacillus pasteurii, Bacillus laevolacticus und Ba-

cillus amyloliquefaciens, ausgewählt werden.

5 25. Teppich gemäß Anspruch 24, wobei die Bakterien im Ruhezustand dem Teppich oder anderem Fasermaterial in einer Konzentration von zwischen ungefähr  $10^6$  und ungefähr  $10^8$  Zellen pro Gramm Teppichfaser beigebracht werden.

10 26. Teppich gemäß Anspruch 25, wobei die Bakterien im Ruhezustand dem Teppich oder anderem Fasermaterial in einer Konzentration von ungefähr  $10^7$  Zellen pro Gramm Teppichfaser beigebracht werden.

15 27. Teppich gemäß Anspruch 24, wobei die Zubereitung aus im Ruhezustand befindlichen Bakterien

	% an Gesamt-Bakterien
Spezies	Bereich
<u>Bacillus licheniformis</u>	20-60
<u>Bacillus pasteurii</u>	10-30
<u>Bacillus laevolacticus</u>	10-30
<u>Bacillus amyloliquefaciens</u>	10-30

20 enthält.

25 28. Teppich gemäß Anspruch 24, wobei die Zubereitung aus im Ruhezustand befindlichen Bakterien

	% an Gesamt-Bakterien
Spezies	
<u>Bacillus licheniformis</u>	40
<u>Bacillus pasteurii</u>	20
<u>Bacillus laevolacticus</u>	20
<u>Bacillus amyloliquefaciens</u>	20

enthält.

30 35 29. Teppich gemäß Anspruch 24, wobei der Teppich ebenfalls mit einem oder mehreren fleckenhemmenden Chemikalien behandelt wurde.

35 40 30. Teppich gemäß Anspruch 29, wobei die eine oder mehrere fleckenhemmende Chemikalien aus der Gruppe bestehend aus sulfoniertem Phenolformaldehydkondensat-Polymer, sulfoniertem Naphthalformaldehydkondensat-Polymer und hydrolysiertem Vinyl aromatischem Maleinsäureanhydrid-Polymer ausgewählt werden.

45 31. Teppich gemäß Anspruch 30, wobei die Zubereitung, die eine Menge fleckenhemmende Chemikalie enthält, in einer solchen Menge zugefügt wurde, dass ein Behandlungsverhältnis von zwischen 0,1 Gew.% und 20 Gew.%, gemessen am behandelten Teppichfasergewicht und der Menge an fleckenhemmender Chemikalie, erreicht wird.

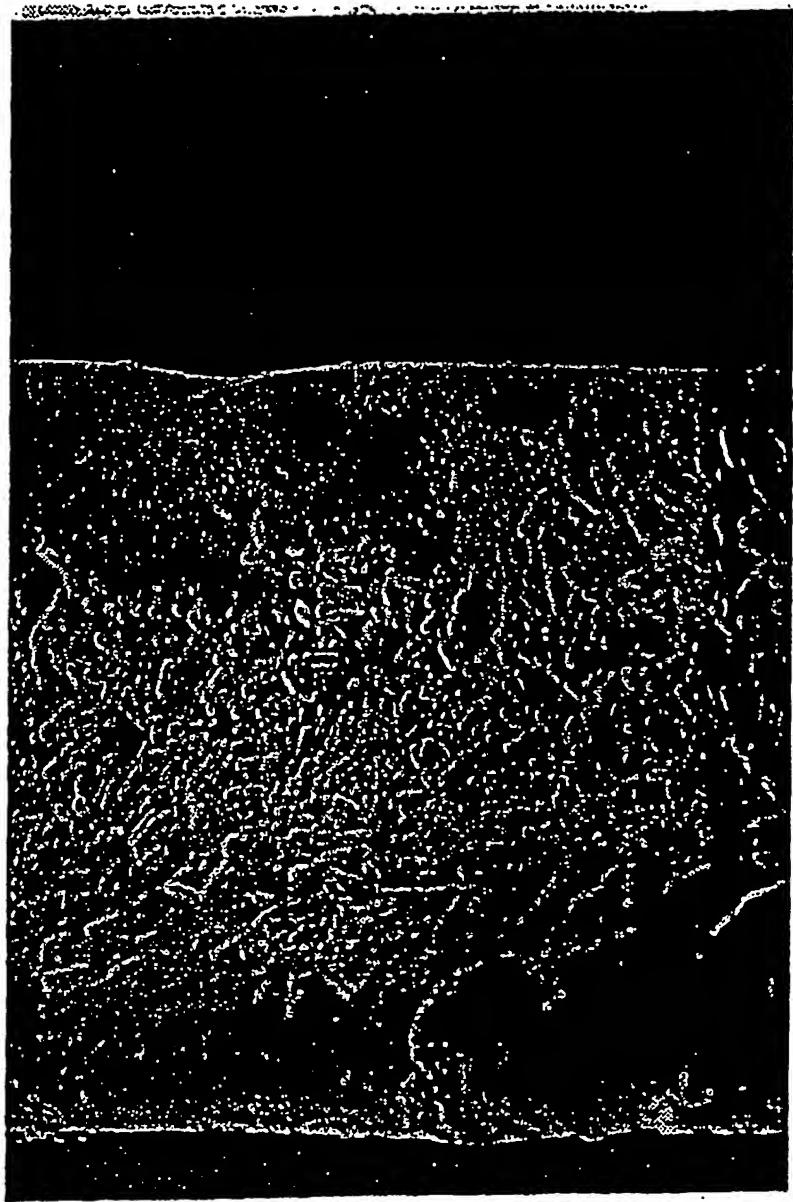
32. Teppich gemäß Anspruch 31, wobei das Behandlungsverhältnis zwischen 0,25Gew.% und 20 Gew.% liegt.

50 33. Teppich gemäß Anspruch 30, wobei der Teppich weiterhin mit einer oder mehreren schmutzabweisenden Fluorverbindungen behandelt wurde.

Figure 1A  
Scanning Electronic Microscopic  
- No Bacteria Added



**Figure 1B**  
**Scanning Electronic Microscopic Results**  
**Fiber with Bacteria Spore Blend**



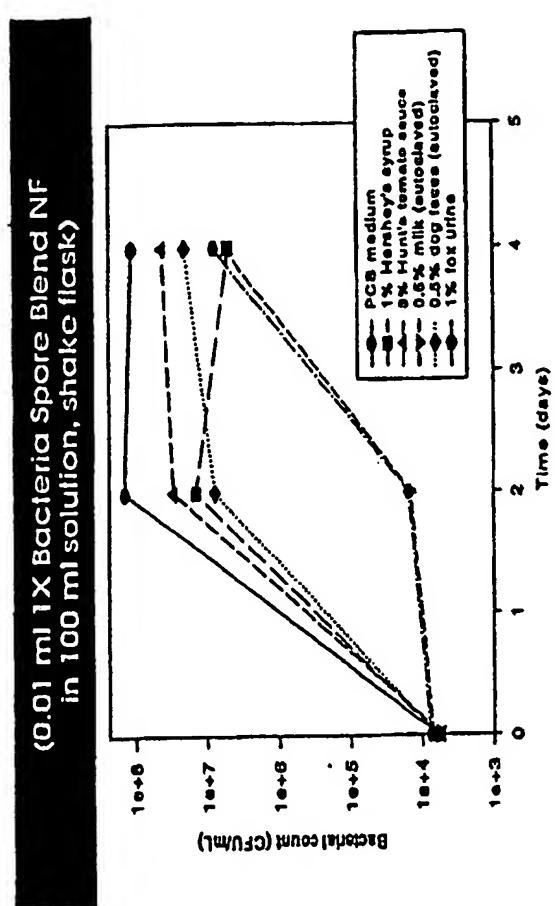


Figure 2

(Respirometric study results: ca. 100% moisture,  
ca.  $10^4$  CFU/g inoculum)

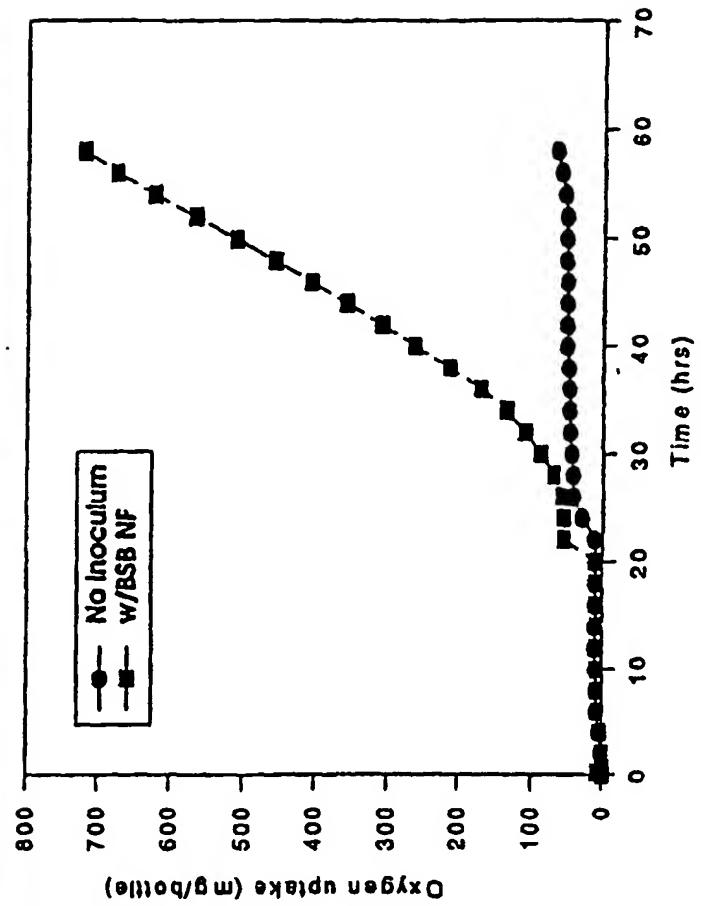


Figure 3

(Respirometric study results; ca. 40 g carpet  
containing 40 g of animal waste solution)

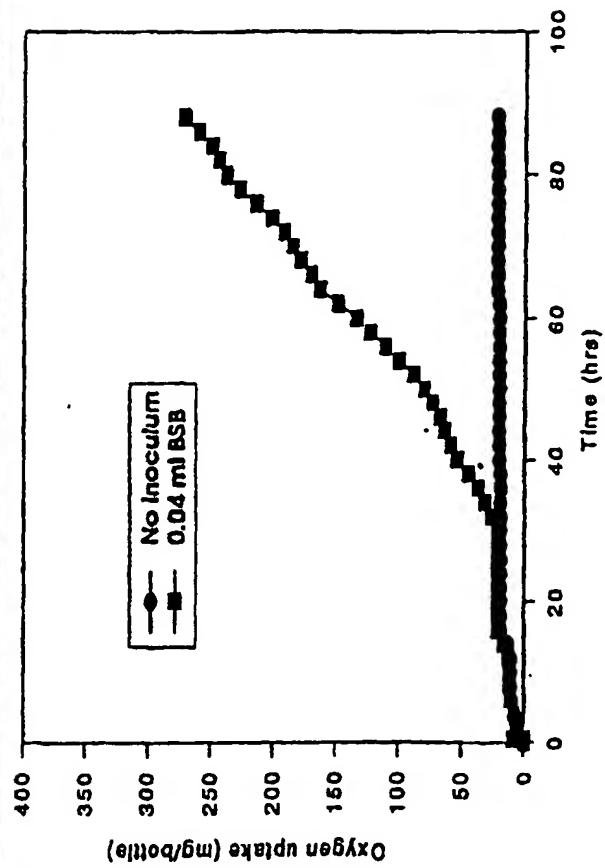


Figure 4

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